A NEW SPECIES OF *BUFO* FROM THE PLIOCENE OF FLORIDA[1]

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Very little information is available concerning the micro-vertebrate fauna of the Florida Pliocene. Recent careful washing and screening of a Middle Pliocene (Hemphillian) deposit near Haile, Alachua County, Florida (Locality Haile VI, A; SW ¼ of Sec. 24, T9S, R18E) has yielded a few remains of small reptiles and amphibians. These include the glass lizard, *Ophisaurus ventralis* (Auffenberg, 1955) and two extinct species of sirenid salamanders (Goin and Auffenberg, 1955). The few anuran remains collected at this locality are considered in the present paper.

Of particular interest are fragmental remains of a toad apparently representing the genus *Bufo*. The morphological characteristics exhibited by the available elements are sufficiently distinctive to warrant specific nomenclatorial designation. The new form is named in honor of Dr. J. A. Tihen, who first brought attention to the extinct Tertiary amphibians of Florida by describing a new species of toad, *Bufo praevius*, from the Thomas Farm Miocene.

BUFO TIHENI sp. nov.

HOLOTYPE.—No. 5203, University of Florida. A fragmentary sacral vertebra (Fig. 1), collected by Walter Auffenberg, 1954.

HORIZON AND TYPE LOCALITY.—Middle Pliocene (Hemphillian), Alachua formation, locality Haile VI, A (SW ¼ Sec. 24, T9S, R18E), near the village of Haile, Alachua County, Florida.

REFERRED SPECIMENS.—UF 5095, a fragmentary sacral vertebra and UF 6363 and 6479 representing four fragmentary ilia. All specimens collected from the same locality and horizon.

DIAGNOSIS.—A Pliocene *Bufo* characterized by the relatively long centrum; the shallow ventral groove between the condyles; the dorso-ventrally compressed centrum and the horizontally oval glenoid cavity; diapophyses relatively close together; transverse dorsal ridge of the neural arch angular, but obtuse, centrally located between the antrior and posterior edges of the neural arch. Ilium with a high dorsal prominence, with a roughened, slightly laterally compressed protuberance at the upper end, and a keel beginning at the shaft and extending up the dorsal prominence on both its anterior and posterior surfaces; dorsal prominence even with, or slightly anterior to the anterior edge of the acetabulum, even with the ventroanterior portion of the acetabular expansion.

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[1] A joint contribution from the Department of Biology and the Florida State Museum.

Discussion.—The sacral vertebrae and ilia possess the typical bufonid characteristics: i.e.: procoelus centrum, with two large, salient condyles and the diapophyses expanded. The ilia are with-

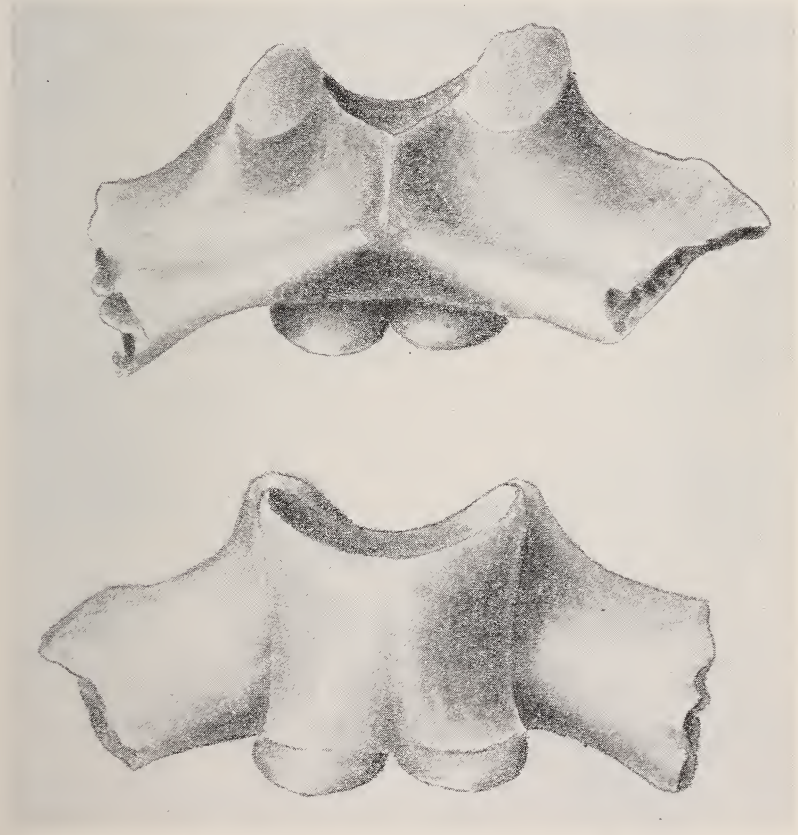

Figure 1. U. F. 5203, the type of *Bufo tiheni* nov. sp. Sacral vertebra collected in 1954 by Walter Auffenberg from locality Haile VI, A (T9S, R18E, SW¼ of Sec. 24), near the village of Haile, Alachua County, Florida. Middle Pliocene (Hemphillian), Alachua fm. ca. x 12.

out a dorsal crest, but provided with a dorsal prominence which is directed dorsally, rather than laterally. Of particular interest however, is the fact that the fossil elements are readily separable from the contemporary eastern representatives of the genus (*B. woodhousei* and *B. terrestris*) and approach those of some of the toads of western United States much more closely. This is particularly evident in the height of the dorsal prominence, which in *tiheni* is high and spine-like, as in *compactilis, punctatus* and *cognatus.* From these species the fossil form is largely distinguished by the fact that the keel is continuous over the top of structure (Fig. 2). The keel, when present at all, is not nearly as well-developed in the Recent forms. It is absent in *Bufo praevius* from the Miocene of Florida, which also differs from *tiheni* in possessing a low prominence similar to that in both *woodhousei* and *terrestris* (Tihen, 1951).

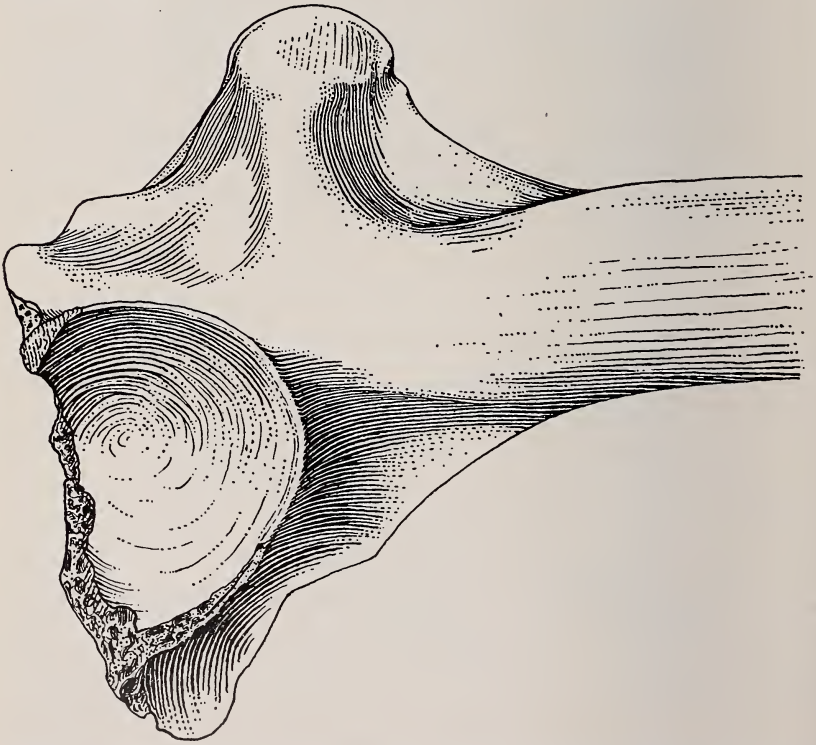

Figure 2. U. F. 6363, Ilium referred to *Bufo tiheni* from the same locality and horizon as the type, illustrating the high, spine-like dorsal prominence. ca. x 21.

On the basis of the cranial crests *praevius* has been shown to be close to *woodhousei* (Auffenberg, 1956). The latter is known from Sangamon interglacial deposits of Kansas (Tihen, 1954). Brattstrom's (1953) record of this species from Florida is erroneous, and the element on which he based his identification is referrable to *Bufo terrestris.* Furthermore, Stratum 3 of Vero Beach, Florida, is now generally considered to be Recent in age.

On the basis of its ilial characters *Bufo tiheni* is approached most closely among fossil toads by forms "A" and "B" of Taylor (1942) from the Upper Pliocene of Kansas. However, the keel, so evident in *tiheni,* is lacking in the Kansas material. The latter are evidently related to the *compactilis-cognatus* complex.

The sacral vertebrae of *B. tiheni* are considerably different from any modern forms I have examined; largely in the greatly compressed centrum, forming a horizontally oval glenoid cavity, and the relatively short distance between the articular facets of the prezygapophyses.

From *woodhousei* and *terrestris* the fossil sacral elements differ chiefly in the characters mentioned above and in having the transverse dorsal keel of the neural arch more centrally located, instead of being placed closer to the posterior edge of the neural arch, and in possessing a greater angle between the two dorsally projected laminae making up the ridge. As regards the latter, *tiheni* is most closely approached by some specimens of *B. compactilis.*

The vertebrae differ from those of *Bufo hibbardi* and *B. arenarius,* described by Taylor (1941) from the Middle Pliocene of Kansas largely in that the elevated ridge on the dorsal surface of the neural arch is well-developed, but rounded, forming an angle greater than 90°; the prezygapophyses are smaller and closer to one another; the diapophyses are narrower and directed more posteriorly; and the groove on the ventral surface of the centrum is restricted to the area between the posterior paired condyles (Fig. 1.), instead of extending more anteriorly.

That *Bufo tiheni* is apparently related to both fossil and Recent species of *Bufo* now found in western North America is of particular importance, especially since the lower Miocene form from Florida is clearly related to the *terrestris-woodhousei* complex.

Certain elements of the Recent reptilian fauna of Florida are highly suggestive of western forms and apparently represent immigrant populations. This is especially true of such genera as

Crotalus, Pituophis, Masticophis, etc. In the West these elements reach their peak of abundance and diversification. In eastern United States they are more or less restricted to open dry forest conditions. Since these or related forms are absent in the Miocene deposits of Florida, but present in the Pleistocene deposits of the State, one would infer that they probably reached this area during, or near, the Pliocene.[2] The fact that *Bufo tiheni,* apparently related to toads now found in western United States, is found in the Pliocene supports this view. The possible occurrence of other species with western affinites, since extinct, in the Pliocene of Florida cannot be denied. Unfortunately, little is known of the rodent fauna present in the peninsula at that time, and the bird fauna described from this period (Brodkorb, 1955) is largely marine or littoral.

Rana cf. *pipiens*

The material referred to this genus and species from the same locality includes six fragmental ilia (UF 6481, 6362, 6471-2, 6474 and 5097) one complete humerus (UF 6486) and one fragmental sacral element (UF 6361).

Although fragmental, the ilia do not seem to represent *grylio, heckscheri* or *catesbeiana.* This is largely based on the shape of the dorsal crest. In these species the angle between the longitudinal axis of the ilial shaft and the posterior edge of the dorsal crest from the top of the crest to the base of the dorsal portion of the acetabular expansion is less than in the fossil ilia. In addition, the postero-dorsal portion of the crest is bent inward, whereas it is straight in the fossil specimens.

On the other hand, the fossil ilia are very similar to those I have examined in *Rana pipiens, R. clamitans, R. capito, R. sylvatica* and *R. palustris.* From *clamitans* the fossil ilia differ in a minor fashion in that the region just anterior to the acetabulum is wider and the angle between the axis of the shaft and the posterior edge of the dorsal crest is somewhat greater in specimens of comparable size. From above the posterior portion of the dorsal crest of *clamitans* is usually bent inwards very slightly. It is straight in all of the available fossil ilia.

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[2] A fossil crotalid from the Pliocene of Florida is now known (Auffenberg, Thesis).

From *sylvatica* the fossils differ chiefly in their larger size, but this is admittedly a poor diagnostic character.

The ilia of *pipiens, palustris* and *capito* are very difficult, if not impossible to separate. Unfortunately, the fossil sacrum is so broken that proportional measurements of this element, used to considerable advantage by Tihen (1954) in separating several species of *Rana,* cannot be utilized.

Apparently the deposit represents an old stream channel. *Rana capito* is now at least an inhabitant of dry forest conditions, leading, for the most part at least, a terrestrial existence. There is little or no suggestion of a dry forest fauna in the deposit, most forms being aquatic, or of a type frequently found in mesic, though perhaps open forest conditions.

Rana palustris and *R. sylvatica* are more northern frogs, not found in Florida at the present time. There are no definite northern faunal elements in the deposit. According to Berry (1916), on the basis of floral remains from another Pliocene locality in Florida, there is little reason to assume that climatic conditions were very different from those existing in the area today.

At least at the present time *Rana pipiens* is a wide spread form that inhabits a variety of ecological conditions. Based on the known facts it seems reasonable to refer the fossil ilia to this species.

The relationships of the Florida form with the other North American Pliocene ranids (LaRivers, 1953; Zweifel, 1954; and Taylor, 1942) remain unknown.

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